

Science Learning Experiences using the 5-E Learning Cycle

- adapted for use in model curriculum development by Linda Lacy, Science Consultant, Curriculum Services, Missouri Department of Elementary and Secondary Education 9/23/2005

Learning Activities	Questions for Students During Instruction	<i>Inconsistent with Model</i>	Teacher's Support	<i>Inconsistent With Model</i>
<u>I. Engagement/Anticipatory Set</u> (Accesses and builds connections with prior knowledge and experiences, stimulates learner's curiosity, provides motivation to learn) <ul style="list-style-type: none"> • Demonstration • Reading • Free Write • Analyze a Graphic Organizer • KWL • Brainstorming 	Student shows interest in the topic by asking and/or answering questions, such as: <ul style="list-style-type: none"> • "What do you observe about this?" • "Why did this happen?" • "What do you already know about this?" • "What can you find out about this?" 	<i>The student:</i> <ul style="list-style-type: none"> • <i>Asks for the "right answer"</i> • <i>Offers the "right answer"</i> • <i>Insists on answers or explanations</i> • <i>Seeks only one solution</i> 	The teacher: <ul style="list-style-type: none"> • Creates interest • Generates curiosity • Raises questions • Elicits responses that uncover what the students know or think about the concept/topic 	<i>The teacher:</i> <ul style="list-style-type: none"> • <i>Explains concepts</i> • <i>Provides definitions and answers</i> • <i>States conclusions</i> • <i>Provides closure</i> • <i>Lectures</i>

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<u>II. Exploration</u> (To satisfy curiosity, build background through exploration of natural phenomena, direct instruction, pre-reading, etc.) <ul style="list-style-type: none"> • Perform an Investigation • Read Authentic Resources to Collect Information • Solve a Problem • Construct a Model 	The student: <ul style="list-style-type: none"> • Personally inquires/ explores and investigates; to satisfy his/her curiosity about the chosen concept/topic. • Thinks freely, but within the limits of the activity. • Tests predictions and hypotheses. • Forms new predictions and hypotheses. • Experiments with alternatives and discusses then with others. • Records observations and ideas. • Suspends judgments. 	The student: <ul style="list-style-type: none"> • <i>Is passively involved, lets others do the thinking and exploring</i> • <i>Works quietly with little or no interaction with others (however, this is appropriate when the student is exploring ideas or feelings)</i> • <i>“Plays around” indiscriminately with no goal in mind</i> • <i>Stops with one solution</i> 	The teacher: <ul style="list-style-type: none"> • Acts as a facilitator. • Encourages the students to work together with minimum supervision. • Observes and listens to the students. • Asks probing questions to redirect the students' investigations when necessary. • Provides time for students to work through problems. 	The teacher: <ul style="list-style-type: none"> • <i>Provides answers</i> • <i>Tells or explains how to work through problems</i> • <i>Provides closure</i> • <i>Tells students that they are wrong</i> • <i>Gives information or facts that solve problems</i> • <i>Leads students step-by-step to a solution</i>

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<p><u>III. Explain</u></p> <p>(Student gains understanding of the concepts and can verify answers to questions or problems. More abstract concepts are introduced and explained. Terms are introduced and defined as appropriate labels for concepts and phenomena.)</p> <ul style="list-style-type: none"> • Student Analysis & Explanation • Supporting Ideas with Evidence • Structured Questioning • Reading and Discussion • Teacher Explanation • Thinking Skill Activities: compare, classify, error analysis 	<p>The student:</p> <ul style="list-style-type: none"> • Uses various informational resources, group discussions, and teacher interaction to derive definitions and explanations of the chosen concept. • Explains possible solutions or answers to others' explanations. • Listens critically to others' explanations. • Questions others' explanations. • Listens to and tries to comprehend explanations the teacher offers. • Refers to previous activities. • Uses recorded observations in explanations 	<p><i>The student:</i></p> <ul style="list-style-type: none"> • <i>Proposes explanations from “thin air” with no relationship to previous experiences</i> • <i>Brings up irrelevant experiences and examples</i> • <i>Accepts explanations without justification</i> • <i>Does not attend to other plausible explanations</i> 	<p>The teacher:</p> <ul style="list-style-type: none"> • Encourages the students to explain concepts and definitions. • Asks for justification (evidence) and clarification from students. • Uses students' previous experiences as the basis for explaining new concepts. • Formally provides definitions, explanations, and new labels. 	<p><i>The teacher:</i></p> <ul style="list-style-type: none"> • <i>Accepts explanations that have no justification</i> • <i>Neglects to solicit students' explanations</i> • <i>Introduces unrelated concepts or skills</i>

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<p><u>IV. Expand/Extend/Elaborate</u></p> <p>(Student discovers ways to expand on what they have learned and apply their newfound knowledge to different situations. They may expand understanding of the concept to other content areas. They test ideas more thoroughly and explore additional relationships. Providing closure to the lesson and verifying student understanding is critical at this point.)</p> <ul style="list-style-type: none"> • Problem Solving • Decision Making • Experimental Inquiry • Thinking Skill <p>Activities: compare, classify, apply</p>	<p>The student:</p> <ul style="list-style-type: none"> • Applies new labels, definitions, explanations and skills in new, yet similar situations. • Uses previous information to ask questions, propose solutions, make decisions, and design experiments. • Draws reasonable conclusions from evidence. • Records observations and explanations. • Checks for peer understanding. • Makes connections and sees relationships of the concept/topic in other content areas. • Forms expanded understanding of original concepts/topics. • Makes connections of concept/topic to real world situations 	<p><i>The student:</i></p> <ul style="list-style-type: none"> • “Plays around with no goal in mind” • <i>Ignores previous information or evidence</i> • <i>Draws conclusions from “thin air”</i> • <i>In discussion uses only labels provided by teacher</i> 	<p>The teacher:</p> <ul style="list-style-type: none"> • Expects the students to use formal labels, definitions, and explanations provided previously. • Encourages the students to apply or extend the concepts and skills in new situations. • Reminds students of the existing evidence and data and asks: <ul style="list-style-type: none"> ▪ What do you already know? ▪ Why do you think ...? • Looks for concepts connecting with other concepts/topics and/or with other content areas. • Asks probing questions to help students see relationships between concept/topic and other content areas 	<p><i>The teacher:</i></p> <ul style="list-style-type: none"> • <i>Provides definitive answers</i> • <i>Tells students that they are wrong</i> • <i>Lectures</i> • <i>Leads students step-by-step to a solution</i> • <i>Explains how to work through problems</i>

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<u>V. Evaluate</u> (Formally assess student understanding of concepts and skills.) <ul style="list-style-type: none"> Any of the Above Develop a Scoring Tool or Rubric Test (selected-response items, constructed-response items, extended/open constructed-response items) Performance Assessment Produce a Product Journal Entry Concept Map Portfolio 	The student: <ul style="list-style-type: none"> Answers open-ended questions by using observations, evidence, and previously accepted explanations. Demonstrates an understanding or knowledge of the concept or skill. Evaluates his or her own progress and knowledge. Uses alternative assessments to demonstrate their understanding of the concept/topic. 	<i>The student:</i> <ul style="list-style-type: none"> <i>Draws conclusions without using evidence or previously accepted explanations</i> <i>Offers only yes or no answers and memorized definitions or explanations as answers</i> <i>Fails to express satisfactory explanations in his or her own words</i> <i>Introduces new, irrelevant topics</i> 	The teacher: <ul style="list-style-type: none"> Observes the students as they apply new concepts and skills. Assesses students' knowledge and/or skills. Looks for evidence that the students have changed their thinking or behaviors. Allows students to assess their own learning and group-process skills. Asks open-ended questions like: <ul style="list-style-type: none"> What evidence do you have? What do you know about...? How would you explain...? 	<i>The teacher:</i> <ul style="list-style-type: none"> <i>Tests vocabulary words, terms, and isolated facts</i> <i>Introduces new ideas or concepts</i> <i>Creates ambiguity</i> <i>Promotes open-ended discussion unrelated to concepts or skills</i>

Resources:

<http://www.miamisci.org/ph/index.html>

<http://www.saguaro.geo.arizona.edu/5-Epdf.pdf>

<http://www.holland.k12.mi.us/curriculum/sci.cycle.html>

<http://www.mcps.k12.md.us/curriculum/science/instr/5Esactivities.htm>